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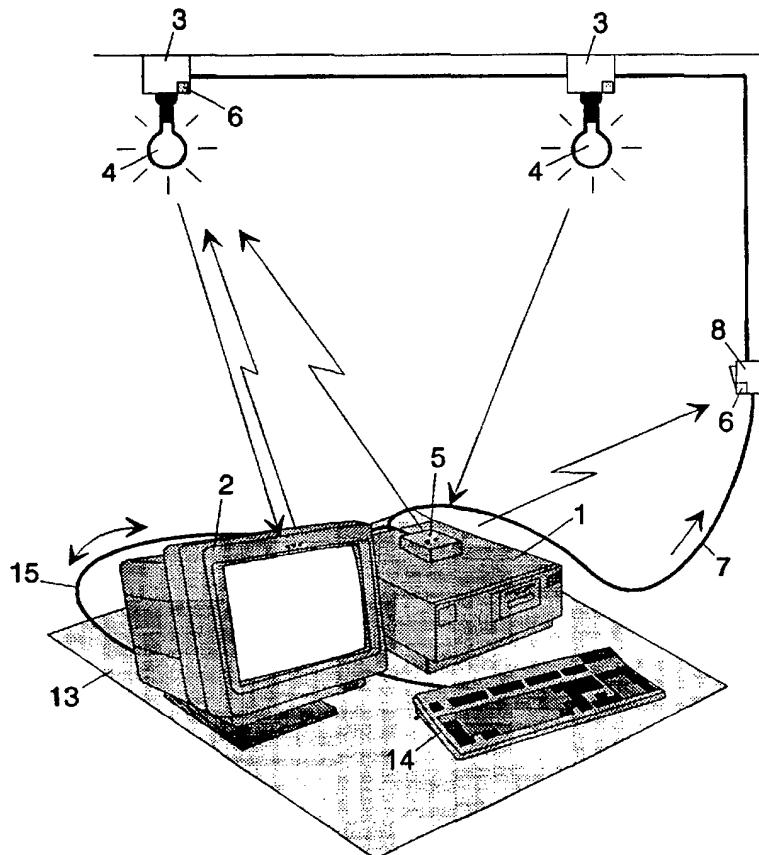
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## (54) Title: CONTROL SYSTEM FOR ONE OR MORE WORKING AREAS

## (57) Abstract

The invention relates to a control system for one or more working areas for controlling the ambient conditions thereof, such as the lighting, temperature, air quality etc., when at least one of the working areas has a general-purpose personal computer (1), and especially for controlling the operational characteristics of the personal computer. For achieving optimum working conditions, the control system of the invention comprises a detection arrangement (2) in connection with the personal computer for measuring or receiving a desired condition or conditions and/or other environmental data, such as presence data, and means for controlling the operational mode and/or controls of the general-purpose personal computer (1) and/or an associated device or associated devices, such as the display unit (13) and the keyboard (14), in response to the information received from the detection arrangement (2).



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Control system for one or more working areas

The present invention relates to a control system for one or more working areas for controlling the ambient conditions thereof, such as the lighting, temperature, air quality etc., when at least one of the working areas has a general-purpose personal computer with software for performing personal tasks, said control system comprising

10 a detection arrangement in connection with the personal computer for measuring or receiving a desired condition or conditions and/or other environmental data, such as presence data,

15 one or more actuators connected so as to influence devices controlling the desired conditions, such as illuminators, blinds, heaters, valves, air-conditioning devices, etc.,

20 control software and/or control circuitry incorporated in or connected to the personal computer for receiving the information retrieved from the detection arrangement and for generating control information, and means for transmitting the control information to the actuators.

25 A home automation system comprising the above-mentioned features is known from U.S. Patent 5 086 385. This known system is intended to control a home environment. Accordingly, several conditions prevailing in working areas with PC equipment and affecting a person's ability to work with the PC have not been taken into account.

30 In office work, general-purpose personal computers are taking over to an ever increasing extent. Thus it has been necessary to pay increasing attention besides the actual computer also to its operational environment, in other words to the conditions prevail-

ing in the working area. These conditions include placing of the display means, placing of the illuminators, the illumination level, prevention of unwanted reflections, heating of the working area, ventilation, 5 air conditioning, etc.

The most modern display means known for example from U.S. Patent 5 083 195 include automatic brightness and/or contrast control for environments in which the lighting cannot be sufficiently controlled. Changes in 10 lighting automatically influence the controls of the display means, and the controls compensate for the change in lighting. For providing this automatic control, the display means includes measuring means indicating the illumination level of the environment.

15 However, display means of the above-described kind, adapting themselves to changes in the lighting conditions of the environment, only solve part of the problem. They are not capable of actively influencing their environment, not even its lighting, still less 20 the other conditions, such as the temperature, sufficiency of ventilation and other ambient factors influencing the working environment. Often the adaptability of the display means to ambient changes even in brightness and/or contrast of the display is insufficient for the 25 display to be optimal in all situations.

On the other hand, for example WO publication 30 8905562 discloses systems in which lighting is controlled with a microprocessor for room-specific maintaining of the illumination level at a preset value or a constant value selected by the user. Such known systems are separate entities, and thus they are relatively costly to purchase and install.

It is an object of the present invention to provide a novel cost-effective control system for one 35 or more working areas to control the personal computers

and devices associated therewith and the ambient conditions in the working area, such as the lighting, temperature, air quality etc. This control system of the invention is characterized in that it further comprises  
5 means for controlling the operational mode and/or controls of the general-purpose personal computer and/or an associated device or associated devices, such as the display unit and the keyboard, in response to the information received from the detection arrangement.  
10

Preferably the means for transmitting control information comprise a wireless transmitter, such as an infrared transmitter, in connection with the personal computer, and a receiver having connection with the  
15 actuator.

Alternatively, the means for transmitting control information comprise a wired connection to the actuator, connected to the serial channel or equivalent of the personal computer.

20 When the system of the invention comprises more than one working areas having a general-purpose personal computer, when the computers communicate with one another through a local area network and when at least one of the computers operates at least as a server, it  
25 is preferred that the means for transmitting control information further comprise said local area network. If necessary, the local area network with server may be operative 24 hours a day.

Further aspects can be added to the system in a  
30 case where the detection arrangement comprises an access control and/or working time monitoring system.

It is further preferred that the detection arrangement comprises at least three light sensors for measuring the lighting and colour temperature of the  
35 working area.

It is further preferred that in addition to the above control measures relating to the environment of the working area, the means for controlling the operational mode and/or controls of the computer or some associated device comprise means for controlling the brightness, colour temperature or gamma correction of the image and/or some other factor, such as switching on or off, of the display associated with the personal computer.

The most important advantage of the system of the invention is that the basic elements needed therein, such as the general-purpose personal computers and local area networks, form part of the outfit of a modern office, and the implementation of the invention only requires incorporation of additional hardware and software, the purchase, installation and operating costs of which are considerably lower than when a separate system is used. The general-purpose personal computers offer an inexpensive base for the necessary sensors and additional software, and the operations necessitated by the system of the invention can be executed by the computers as background runs alongside normal applications, without the user noticing them and without substantial impairment of the capacity of the equipment.

In the following the system of the invention and its characteristics will be set forth in greater detail with reference to the accompanying drawing, wherein

Figure 1 shows an exemplary setup of a control system according to the invention in the case of one working area,

Figure 2 shows an exemplary setup of the system of the invention in the case of several working areas, and

Figure 3 shows a modification of the variant of the system of the invention comprising several working areas.

Figure 1 shows a control system according to the invention, when the system comprises one general-purpose personal computer 1 participating in a desired control function and when the desired factor to be controlled is the lighting of the environment (in addition to the control of the display connected to the computer), either solely for the working area concerned or also for several neighbouring working areas, which may naturally also have personal computers not participating in said control task. The computer 1 incorporates a display unit 13 and a keyboard 14. One or several, for example three light sensors 2 are disposed at the upper edge of the display unit 13, measuring the amount of incoming light from the environment, for instance from illuminators 4, in other words, virtually the ambient lighting level. In response to this, the control software and/or control circuitry incorporated in the computer 1 calculates, on the basis of algorithms, tables or the like incorporated in the software and/or circuitry, control information to be sent to the illuminators on the one hand and to the display driver and/or display unit 13 of the computer 1 on the other hand, in order to make the illumination and the quality of the image on the display optimal for display terminal work and other work as well.

The control information can advantageously be transmitted to the display 13 unit from the computer 1 over a wired connection, i.e. a cable 15 between the computer 1 and display unit 13. In Figure 1, the control information has been shown to be transmitted by two alternative routes. One of these employs an infrared transmitter 5 connected to the computer 1, sending

the control information as an infrared message to actuators 3 for illuminators 4 via infrared receivers 6 incorporated in said actuators. The actuators 3 control, in response to this control information, the 5 lighting either by altering its brightness, in which case the actuator is a dimmer, or by switching on/off some of the illuminators. Different channels or different command codes can be used for different illuminators. Furthermore, also the illuminators can be 10 controlled, as far as the light sensors 2 of the display unit 13 are adapted to measure also the ambient colour temperature in addition to the lighting, to achieve the desired ambient colour temperature. This can be effected by changing the colour temperature of 15 the light emitted by the illuminator for instance by incorporating in the illuminators several light sources generating several different colour temperatures and by dimming them, suitably connecting them to be switched on/off or using different filters to obtain the desired colour temperature. In Figure 1, a line 7 has been 20 shown as an alternative control path, said line being connected to the serial channel or equivalent of the computer 1 on the one hand and to a control box 8 for the illuminators 4 and comprising a suitable actuator, such as a dimmer or switch, or permitting changeover of 25 the control to the actuator 3, on the other hand.

Figure 1 is merely a schematic representation of how both the ambient lighting and the image on the display 13 can be controlled by means of the personal computer included in the working area. The present invention, however, is applicable to all ambient conditions 30 of the working area, such as the control of temperature, air quality etc., combinations of these conditions included. Such a system corresponds fully to the system 35 shown in Figure 1. For example, in a system controlling

the temperature the sensors are naturally temperature sensors and the actuators are for instance radiator valves or thermostats for heating radiators. Similarly, ventilation valves in the vicinity of the working area can be controlled. The control can naturally also involve various ionizers or air cleaners and the detectors can be indicators or sensors of the smoke or particle content.

Since it is inessential to the invention whether the structures/functions basic to the invention are incorporated in the actual general-purpose personal computer or in given equipment connected to it, the control system can be entirely built around the display unit or a video signal-controlling display driver. Also the means for transmitting control information to the actuators can be similarly placed.

In the system of the invention, the detector and the transmitter can thus be incorporated in or connected to the personal computer for example at a control box 5 or a display unit 2, as shown in the system of Figure 1, or at another suitable location at which the desired aspect of the environment can be measured and information thereon transmitted for handling by the computer.

The desired ambient condition can be controlled over a wired connection, such as line 7 shown in Figure 1, for example through a serial channel or equivalent of the personal computer, or in a wireless manner for example by infrared/radio control, as is also shown in Figure 1. The infrared transmission path seems to be the most suitable in practice.

As stated previously, the control according to the invention - if only lighting control is contemplated - has three main targets. First, the characteristics of the personal computer's own display unit,

such as the illumination, contrast, characteristics/gamma correction and other such controls, lighting in the immediate vicinity of the personal computer, i.e. virtually the lighting of the working area, and  
5 lighting in the broader environment of the computer, such as the lighting of working areas having no personal computer or otherwise forming an integrated whole in the environment of the control system of the invention.

10 Similarly as the electric lighting of a room or a working area can be controlled, also the natural light coming into the room can be controlled for example by altering the transparency of a window by means of an adjustable film disposed thereon or by using  
15 various blinds or other equivalent means. Thus, considering lighting alone, the control method of the invention can control various characteristics of the display unit, the colour temperature and gamma correction of the display, the amplitude, colour temperature and gamma correction of the video signal of the computer, the intensity of the lighting, the colour temperature of the lighting and the intensity and colour temperature of natural light, and combinations of these.  
20

25 If the general-purpose personal computer incorporates several processors, the control operations in accordance with the invention can be centralized in only one of them (or in only some of them), said processor being operative 24 hours a day, if necessary.  
30 The invention can be advantageously applied also when the operating system of the personal computer enables simultaneous execution of several tasks. In the control system of the invention, the operation time of the control processor and incorporated software and the  
35 associated sensors can be adjusted by way of software

independently of the master computer, depending on whether one wishes to monitor the controlled area also when the user of said personal computer is not present. One alternative is that the processor always performs  
5 the adjustment operations in connection with startup and log off and at regular intervals in interrupted state.

In the following, the control system of the invention will be described with reference to Figure 2  
10 in a case where there are more than one working areas having a general-purpose personal computer and said computers communicate with one another through a local area network 9 or equivalent, and where at least one of these computers operates at least as a server in the  
15 control system of the invention. This computer operating as a server in the system of Figure 2 is denoted by reference 1'. Also Figure 2 shows a control system relating merely to lighting adjustment, comprising a plurality of general-purpose personal computers 1 and a local area network 9 connecting them. The working area-specific procedure is the same as in the system of Figure 1. In this case, however, the computer operating as a server 1 is the computer in which the necessary control software and/or control circuitry is incorporated, at least for the most part. Further, an access control and/or working time monitoring terminal 10 is connected to the server 1' via a line 16. From this terminal, information is received on the fact that an employee has either arrived at work or left work. In  
20 consequence, when an employee arrives at work, the server 1 can automatically start a person's computer 1 and control through said computer the lighting of his working area to be optimal. The object is to reach ergonomically as good a result in the lighting of the  
25 working environment and the working area as possible.  
30  
35

Thus in the system of Figure 2, the means for transmitting control information from the control software and/or control circuitry incorporated in the personal computer also include a local area network 9 in addition to the equipment already described in the context of Figure 1.

In the system of Figure 2, in addition to the fact that the server controls the lighting by means of measuring data retrieved from the computers, also the user can enter control data into the server from his own computer 1. Whether the control software and/or control circuitry is entirely incorporated in the server 1' or whether it is distributed to each computer 1 to some extent, is merely a question of expediency.

After all employees have left the premises, the control system of the invention can adjust the lighting of the entire area, either switching it off or suitably cutting it down. In that connection, the lighting of spaces of different types, such as washrooms, public spaces, passageways, staircases etc. can be adjusted room-specifically. The server can be connected to control the electricity room or air conditioning room of the building/floor, or the computers controlling these are directly connected to the same network and the server controls them via the local area network.

Figure 3 shows a control system according to the invention in a case where it also includes a computer 12 making use of cameras 11 performing access control. Instead of cameras or in addition to them, for example remote-read ID cards can be used to identify persons. In the system of Figure 3, the access control and/or working time monitoring terminal 10 is connected to a computer 1' which can operate as a server for the computers interfaced with the local area network 9. Also in the system of Figure 3, the procedure can be

such that when the system detects the arrival of the user at work, his computer can be started automatically, lighting can be switched on in the working area, air-conditioning of the working area can be commenced etc. already before the employee has arrived at his working area. Likewise, the equipment and lighting can be switched off automatically when the user finishes his working-day. Thus a considerable amount of energy and costs are saved. When the employee has a meeting or the like elsewhere in the building, the lighting and even an useless computer in the working area can be switched off automatically, if desired.

At the same time, security considerations can be observed and embraced in the same solution: The display unit of the user's computer is switched off (cleared or image off) and the peripheral equipment is locked (keyboard, mouse, pointing device), which prevents unauthorized use of the equipment and data leakage from the screen of the display unit. An alarm can be generated to a guard when an unauthorized intruder attempts to use the equipment or the local area network, and thus the intruder can be caught without any external alarm. For this function, Figure 3 shows a computer 17 receiving control data from the computer 1 and generating an alarm of an unauthorized use attempt.

If the user wishes to establish a connection to another user whose personal computer is interfaced with the same local area network 9 and said person is not accessible, the switched access control system can indicate when the person whom one attempts to reach arrives at work.

An access control camera 11 can advantageously be employed for controlling the lighting and the premises. In accordance with Figure 3, the access control camera is connected to the video digitizing card (e.g.

DVI card) of a computer connected to the local area network 9, in Figure 3 computer 12. In addition to pattern recognition, the card can attend to the lighting control program block either for the environment of  
5 said computer or for the area of the pertinent part of the local area network 9, and thus specifically this computer 12 operates as a server in the local area network 9 in this regard rather than the computer 1' having connection to the working hours monitoring  
10 terminal 10. As is apparent herefrom, for reasons of expediency the different functions of the system can be distributed in the desired manner to be executed by the different computers. In the system of Figure 3, the local area network can be used for access control data  
15 transmission. The access control can be realized as a remote operation, without the unauthorized intruder being aware of the control. A card of the DVI type, for example, can compress image information to be transmitted in the local area network 9 in a case where an  
20 intruder is detected. The remote guard can be within reach of a telephone connection and select, as need be, a sending from a camera in the building (via an ISDN network, for example). If the situation warrants, the sending can be requested as a remote-controlled play-  
25 back from a videotape recorder. If the access control camera is in the vicinity of the user, the video signal received therefrom can also be employed for measuring the light intensity, light distribution and colour temperature of the environment.

30 In all of the systems described in Figures 1-3 above, the control is realized arithmetically by means of formulae, graphs and tables stored in the control software and/or control circuitry of a personal computer with a view to achieving optimum ergonomics for  
35 the working environment. If for the sake of simplicity

only lighting is considered and the control of temperature, air conditioning and the like is disregarded in this connection, e.g. the following factors can be influenced: avoiding of reflections on the display, 5 optimum brightness and contrast of display for user as ambient conditions change, optimum control of ambient conditions, optimum control of ambient computers and display unit/personal computer, special features and wishes opted for by user and optimizing of wishes between different users. The necessary graphs, tables and 10 computational methods can be designed with the aid of the knowledge on illumination and illumination ergonomics. Furthermore, user-specific options can be incorporated in the equipment and system very easily and 15 inexpensively. Examples of these are an access control connection, automatic switching on/off and control of lighting in accordance with time/arrival at work/work situation/use of working area (monitoring of presence of user for instance with an infrared sensor or a 20 remote-read ID card), other control of environment, such as air conditioning, heating etc., as set forth in the above.

In the foregoing the control system of the invention has been described only by means of one exemplary embodiment, specifically an example relating to the illumination of a working area or working areas, and it is to be understood that the system of the invention can also be applied to many other ambient factors of a working area without departing from the 25 scope defined in the appended claims. Further, it should be noted, as is apparent from the foregoing, that the control system of the invention is naturally capable of controlling several factors influencing the environmental conditions of the working area simultaneously. Thus the control system can comprise, for ex- 30 35

ample, control of illumination, temperature and air quality in the same control system.

## Claims:

1. A control system for one or more working areas for controlling the ambient conditions thereof,  
5 such as the lighting, temperature, air quality etc., when at least one of the working areas has a general-purpose personal computer (1) with software for performing personal tasks, said control system comprising  
10 a detection arrangement (2) in connection with the personal computer for measuring or receiving a desired condition or conditions and/or other environmental data, such as presence data,  
15 one or more actuators (3, 8) connected so as to influence devices controlling the desired conditions, such as illuminators (4), blinds, heaters, valves, air-conditioning devices, etc.,  
20 control software and/or control circuitry incorporated in or connected to the personal computer (1) for receiving the information retrieved from the detection arrangement (2) and for generating control information, and  
25 means (5, 6, 7) for transmitting the control information to the actuators, characterized in that it further comprises means for controlling the operational mode and/or controls of the general-purpose personal computer (1) and/or an associated device or associated devices, such as the display unit (13) and the keyboard (14), in response to the information received from the detection arrangement (2).  
30 2. A control system as claimed in claim 1, characterized in that the means for controlling the operational mode and/or controls of the computer (1) or some associated device comprise means for controlling the brightness, colour temperature or gamma correction of the image and/or some other factor,  
35

such as switching on or off, of the display (13) associated with the personal computer.

3. A control system as claimed in claim 2, characterized in that the means for controlling the operational mode and/or controls of the computer (1) or some associated device comprise means for controlling signals transmitted in a cable (15) between the computer (1) and the display unit (13) for example to control the video signal level, amplitude, colour temperature and/or gamma correction and/or some other factor, such as switching on or off of the display (13).

4. A control system as claimed in claim 2, characterized in that the means for controlling the operational mode and/or controls of the computer (1) or some associated device comprise means for preventing the use of the computer and/or associated equipment, such as means for locking the keyboard (14).

5. A control system as claimed in claim 1, characterized in that the detector arrangement comprises one or more light sensors (2) for measuring the illumination of the working area.

6. A control system as claimed in claim 5, characterized in that the detector arrangement comprises at least three light sensors (2) for measuring the illumination and colour temperature of the working area.

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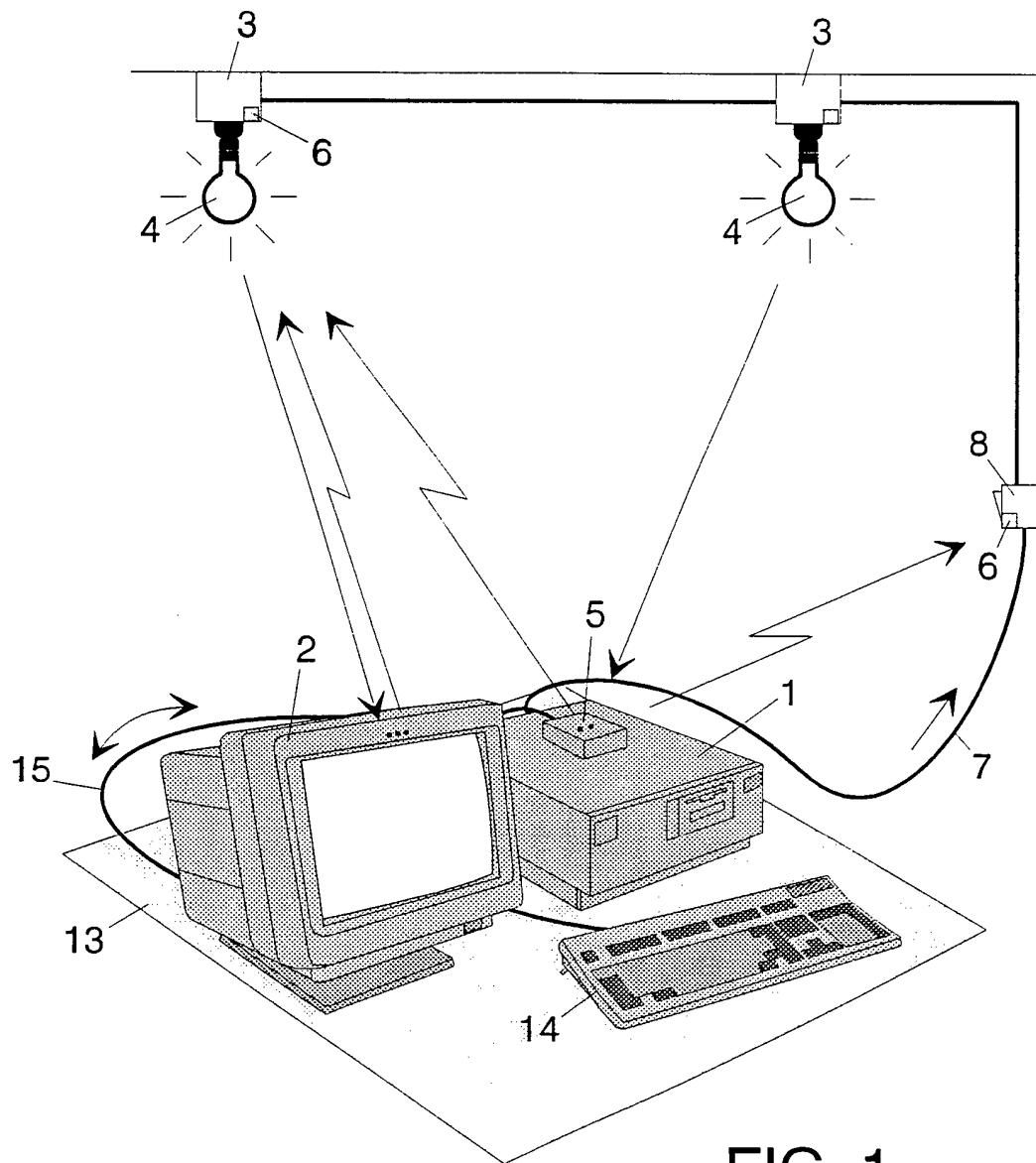
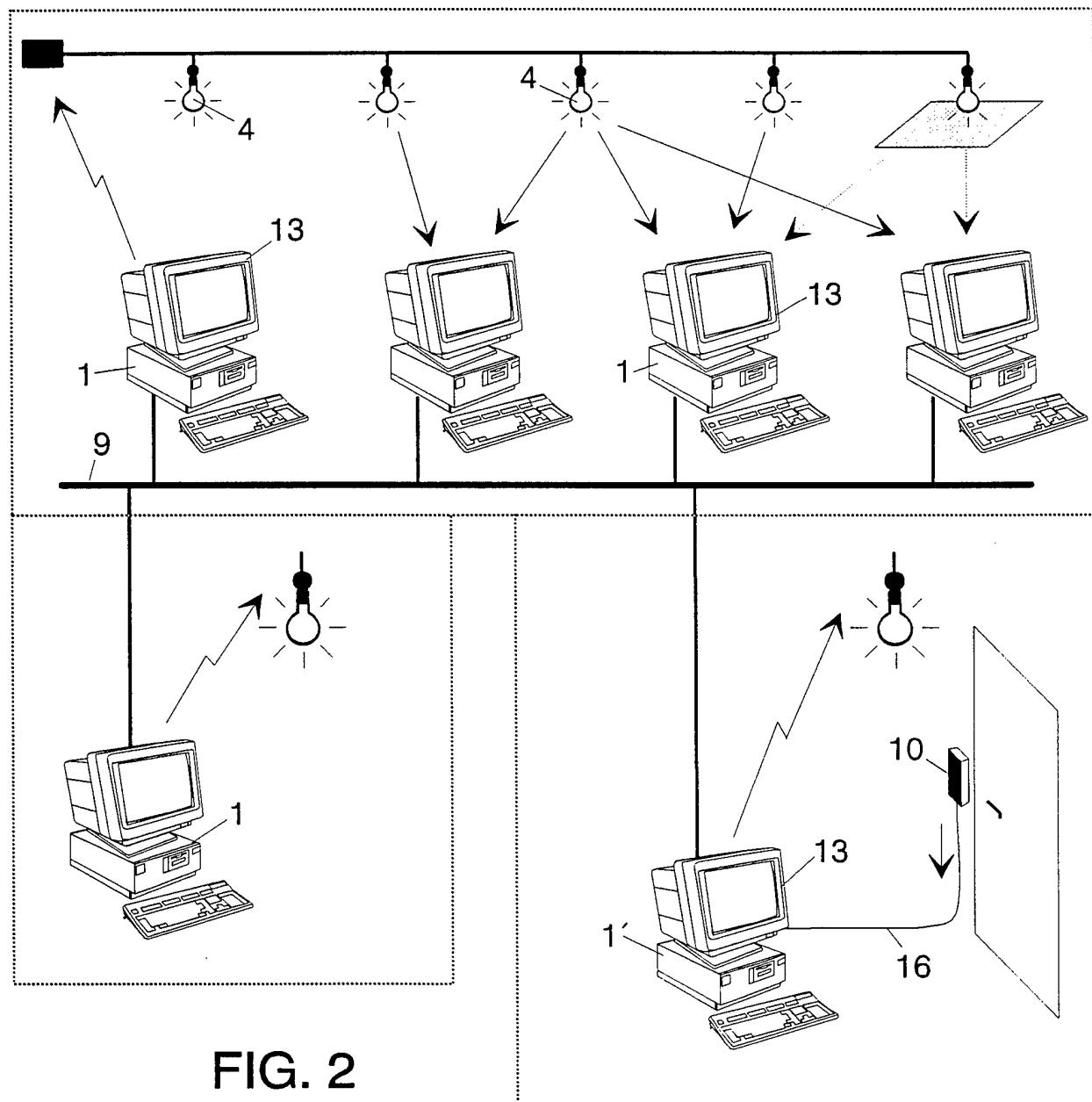


FIG. 1

**FIG. 2**

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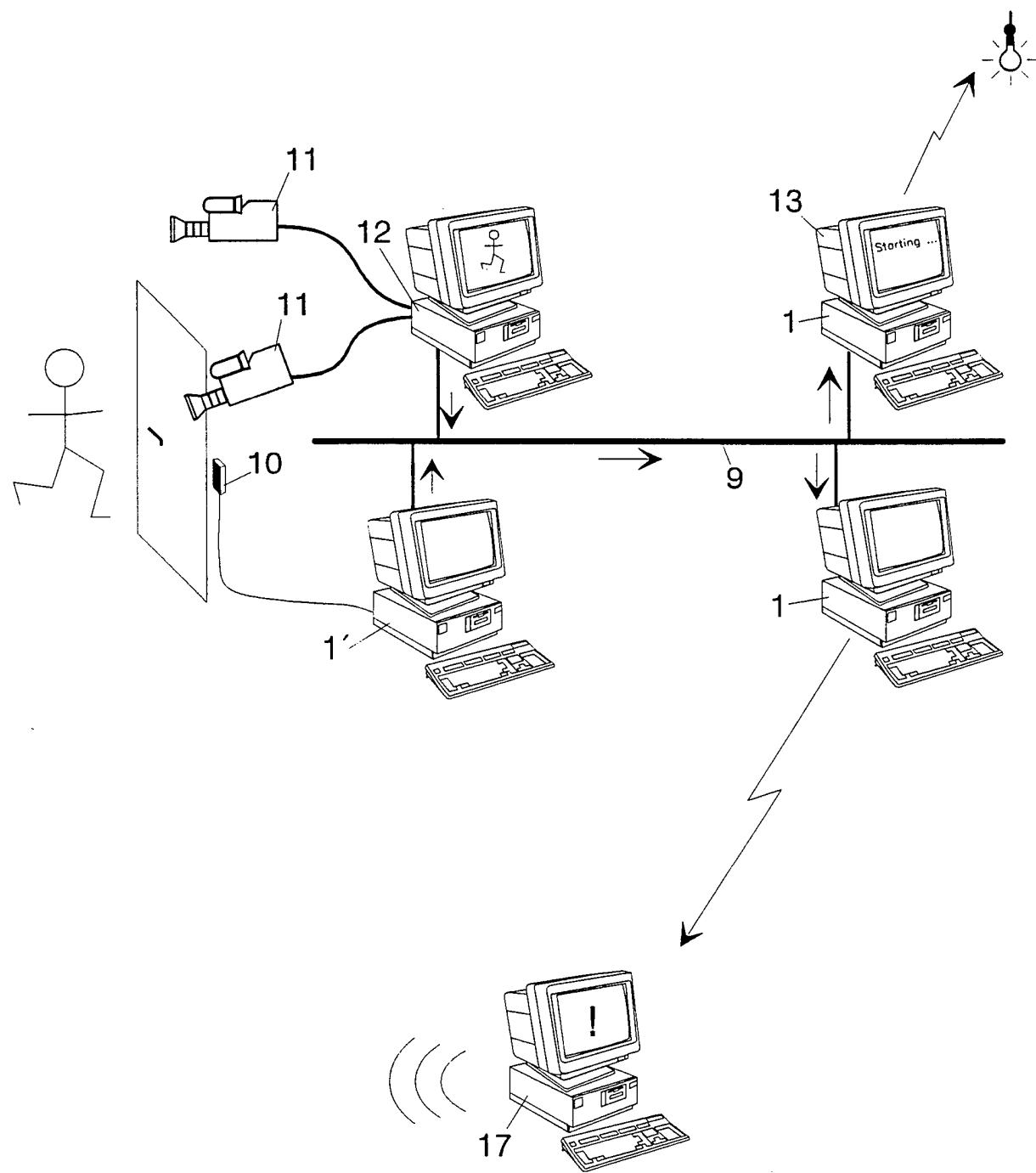


FIG. 3

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 93/00548

## A. CLASSIFICATION OF SUBJECT MATTER

IPC5: G06F 1/00, G05B 15/02

According to International Patent Classification (IPC) or to both national classification and IPC

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Minimum documentation searched (classification system followed by classification symbols)

IPC5: G06F, G05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

ORBIT, WPAT, USPM, JAPIO

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5086385 (REUEL O LAUNAY ET AL), 4 February 1992 (04.02.92), column 8, line 17 - line 24; column 8, line 62 - column 9, line 8  --	1-6
Y	US, A, 5083195 (GRAHAM C. EVELIN), 21 January 1992 (21.01.92), column 1, line 34 - line 47, figure 1  --	1,2,3,5,6
Y	Patent Abstracts of Japan, Vol 11, No 366, P-641, abstract of JP, A, 62-139019 (TOSHIBA CORP), 22 June 1987 (22.06.87)  --	1

 Further documents are listed in the continuation of Box C. See patent family annex.

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## INTERNATIONAL SEARCH REPORT

International application No. PCT/FI 93/00548
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## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	IBM Technical Disclosure Bulletin, Volume 32, No 3A, August 1989, ., "HARDWARE MONITOR SECURITY FEATURE" page 284 - page 285  --	4
A	Patent Abstracts of Japan, Vol 9, No 68, P-344, abstract of JP, A, 59-201103 (SANYO DENKI K.K.), 14 November 1984 (14.11.84)  --	1-6
A	Patent Abstracts of Japan, Vol 12, No 194, P-713, abstract of JP, A, 63-720 (NEC. CORP), 5 January 1988 (05.01.88)  -- -----	1-6

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

26/02/94

International application No.  
PCT/FI 93/00548

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 5086385	04/02/92	NONE	
US-A- 5083195	21/01/92	DE-T- 68909505 EP-A,B- 0347191	20/01/94 20/12/89